

satisfactorily explained by the innate adaptation of their sensitive cognition and appetite, whereas the hypothesis of animal intelligence is unable to offer any solution."

"Instinctive sagacity" seems to me, I confess, a contradiction in terms.

I admit that the subject is one of much difficulty, but if an ant applied Father Wassmann's rigorous criticism to man himself, I am not sure that our boasted gift of reason could be absolutely proved.

No doubt animals do stupid things, but so do we.

Father Wassmann describes what he justly calls the "lovely scenes" in an ant's nest—the care of the young, the "motherly tenderness" shown to the delicate pupæ—but denies that this is any evidence of affection, and contrasts it with the love of a woman or a man for their children. This, he maintains, "is a *rational* love, *conscious of duty* (the italics are his), therefore it is the highest and noblest love existing in Nature." Far be it from me to say a word against either reason or duty. They are amongst the highest qualities of our nature; but surely they have nothing to do with the love we feel for our children, which rests on even nobler feelings.

While fully recognising, then, the accuracy and interest of Father Wassmann's observations, and after carefully considering his arguments, I cannot but recognise in animals some vestiges and glimmerings of intelligence, and maintain, as I did thirty years ago, that "when we see an ant-hill, tenanted by thousands of industrious inhabitants, excavating chambers, forming tunnels, making roads, guarding their home, gathering food, feeding the young, tending their domestic animals—each one fulfilling its duties industriously, and without confusion—it is difficult altogether to deny to them the gift of reason; and the preceding observations tend to confirm the opinion that their mental powers differ from those of men, not so much in kind as in degree."

AVEBURY.

MAXWELL'S THEORY OF LIGHT.

The Electromagnetic Theory of Light. By Dr. C. E. Curry. Part i. Pp. xv+400. (London: Macmillan and Co., Ltd., 1905.) Price 12s. net.

DR. CURRY bases his work, which is almost entirely analytical, on Maxwell's equations of the electromagnetic field. These equations suffice to account for the phenomena of electromagnetism, and the book is a discussion of the properties of electromagnetic waves in which the condition that the wavelength is short is generally, but by no means always, introduced. In these equations four vectors are concerned, the electric and magnetic forces, and the electric and magnetic displacements, or, as Dr. Curry prefers to call them, the electric and magnetic moments. The type of equation satisfied by each of these vectors is the same, and it is not necessary for Dr. Curry's purpose to identify the light vector definitely with either. It is another vector satisfying an equation of the same type.

No attempt is made to give a mechanical account

of the properties of the ether; it is a medium in which transverse waves of electric and magnetic force are propagated according to the laws indicated by Maxwell's equations; in a crystal, however, of course the direction of the electric force does not lie in the wave-front; the same is true of the magnetic force if the permeability be a function of the direction.

Working on these lines, Dr. Curry has put together a large amount of information as to the analytical properties of such waves. The earlier chapters are entirely taken up with the discussion of the forms defined by certain particular solutions of the equations of motion, for if $\phi \equiv f(r \pm vt)/r$ be a solution, so is $d^n \phi / dx^2 dy^2 dz^2$, where $n = \lambda + \mu + \nu$. Some of the solutions thus obtained are of importance in the theory of light, but, as the author states, their interest is chiefly theoretical; and one of his "chief reasons for the elaborate treatment of this particular class of waves has been to indicate another fertile field of research offered by Maxwell's equations."

In chapter iv. we are introduced to the phenomena of interference, treated at first in a simple manner, but applied later to the various kinds of waves the properties of which have already been discussed. The more usual problems of optics first become prominent in chapter v., which deals in the ordinary way with Huyghens's principle and its application to the rectilinear propagation of light. The first difficulty occurs in the attempt to find an expression for the secondary disturbance transmitted from a given element of a primary wave. Such expression may clearly involve the angle ϕ between the normal to the wave and the direction in which the secondary disturbance is being estimated, but the statement that "it is natural to assume that the law of variation of the light vector . . . be according to the cosine of the obliquity of the angle ϕ " is not very convincing, and there seems no reason for calling this law the "natural law of obliquity." The law is, of course, a simple one, and it allows of the analytical solution of various problems which are hardly tractable when a more complex law is assumed; but this is its sole merit. Stokes showed that the true factor is $(1 + \cos \phi)$, and this law is utilised later on; but the physical reason for the change of phase in consequence of which the secondary disturbance from a wave $\sin k(vt - r)$ becomes proportional to $\cos k(vt - r)$ is not discussed as fully as its importance deserves. On these points, reference might with advantage have been made to Prof. Schuster's article in the *Philosophical Magazine*, vol. xxxi.—it is quoted later on another point—or to Lord Rayleigh's article in the *Encyclopædia Britannica*." Following this a rigorous proof of Huyghens's principle is given in the usual way from the consideration of the relations existing between certain volume and surface integrals, and the result is applied to optical problems; but the fact that this rigorous analysis leads to Stokes's law of obliquity is not definitely stated, though it follows at once from the formulæ on p. 176.

Diffraction phenomena are explained by the use of the same principles, employing the most general formula for the secondary disturbance, and assuming

that the disturbance is zero over the opaque portion of the diffracting screen, while over the transparent portion it has the same value as though the screen were absent. The results are applied to the problem of diffraction by a straight edge leading to Fresnel's integrals and the properties of Cornu's spiral. These might have been obtained more simply, though the rigorous method has its advantages in enabling one to see the meaning of the various simplifications introduced in the process. Later on in the discussion an interesting account of Sommerfeld's theory is given.

The latter part of the book is taken up with the usual theory of reflection and refraction and of double refraction. The surface conditions are deduced from the electromagnetic equations, and the relations between the incident reflected and refracted vectors follow readily. Attention is directed to the fact that the laws thus deduced do not hold for light, and the effect of a transition layer is considered in a satisfactory manner.

In the last chapter we have the equations relating to the propagation, reflection, and refraction of electromagnetic waves by crystals.

At present, part i. only of the whole treatise is under consideration. This deals, as will have been observed, with the analytical portions of the subject for which Maxwell's theory gives a satisfactory explanation. In part ii. the author hopes to consider the really more interesting portions where the simple Maxwell theory needs modifications before it will fit the facts. Readers will await with interest Dr. Curry's treatment of the phenomena of the rotation of the plane of polarisation, absorption, metallic reflection, the Zeeman effect, and the relations generally between magnetism and light.

INDIAN HERMIT CRABS.

Catalogue of the Indian Decapod Crustacea in the Collection of the Indian Museum. Part ii. *Anomura.* Fasciculus i., *Pagurides.* By A. Alcock, M.B., LL.D., F.R.S., C.I.E. (Calcutta: Indian Museum, 1905.) Price 14 rupees.

THE second instalment of Dr. Alcock's fine "Catalogue of the Indian Decapod Crustacea" is now before us. It deals with the hermit crabs (*Paguridea* or *Pagurides*), and forms the first fascicule of the second part, which is devoted to the *Anomura*. Dr. Alcock is thus making use of the old classification of the *Decapoda* into *Brachyura*, *Anomura*, and *Macrura*, a course to which modern opinion seems to incline—and, as we think, rightly—in spite of the many merits of Boas's arrangement of the group under the suborders *Reptantia* and *Natantia*. In the hands of different authors, the limits of the *Anomura* have varied considerably, and Dr. Alcock takes the term in the sense of Boas's *Anomura*, including under it the *Paguridea*, *Galatheidea*, and *Hippidea* only. Now there can be no question that Boas was right in excluding the sponge crabs (*Dromiacea*) and sand crabs (*Oxystomata*) from the *Anomura* when he formed his tribe *Anomala*, but we believe that the group thus constituted is still an imperfect one, in

that it is not true to genealogy, since it omits the *Thalassinidea*, which are certainly more nearly akin to the primitive hermit crabs than they are to the lobsters, near which they are generally placed. This is not denied by Dr. Alcock, but he gives as his reason for taking the old course with the *Thalassinidea* that to include them with the *Anomura* "is going too far, as being likely to confuse the systematist"—a poor compliment to the systematist! A zoological classification must be one of two things—either purely empirical, or based on genealogical facts so far as we can ascertain them, though no one is likely to choose the former alternative at this time of day—but in either case illogical concessions to supposed infirmities of the human intellect do not seem to us to be admissible. However, authorities will never agree on questions of classification, and we do not regard the author's decision as a serious blemish on this otherwise wholly admirable work.

In this volume, as in that on the Indian crabs, Dr. Alcock starts with an introduction on the group as a whole, in which he has condensed into a few pages a great deal of very interesting and useful information. In the tables of distribution which follow it appears that the littoral forms are generally Indo-Pacific in range, but that the more primitive sublittoral genera have a very distinct circumtropical distribution. The bearing of this fact on geographical problems is, of course, an important one. The bulk of the work is taken up with systematic descriptions, which are as excellent as is all Dr. Alcock's work in this line, and deal with some ninety species of twenty-eight genera. At the end of the volume is a "table of the genera and species of *Pagurides*," with bibliographical references, which must have been extremely laborious to compile, but will now be correspondingly helpful to systematists. The illustrations are excellent. L. A. B.

OUR BOOK SHELF.

Traditions of the Caddo. Collected under the auspices of the Carnegie Institution of Washington by George A. Dorsey, Curator of Anthropology, Field Columbian Museum. Pp. 136. (Washington, D.C.: Carnegie Institution, 1905.)

THE make-up of this volume is somewhat curious. It contains one hundred and one pages of texts, followed by twenty-eight pages of abstracts of the same in small type; there is no index, and the only notes are almost monosyllabic, for they merely indicate by whom the story was told—a fact of little value, inasmuch as we learn absolutely nothing of the narrator beyond his (or her) name. This is the more regrettable, as the *Caddo*, a tribe allied to the Pawnee and Arikara and associated more especially with the Wichita, has retained none of its ancient culture, and we must therefore know the history of the tribe and of the individual narrators before we can judge of the influences that have gone to shape their stock of folk-tales. Equally regrettable is the absence of notes on the stories themselves; it is true that native names are translated, but there are many points on which the editor could throw light with advantage; for example, in tale 35 we find a dead man cannot get into Spirit Land because he cannot fit his arrows to his bow-string, which has a knot in it; a living man puts in